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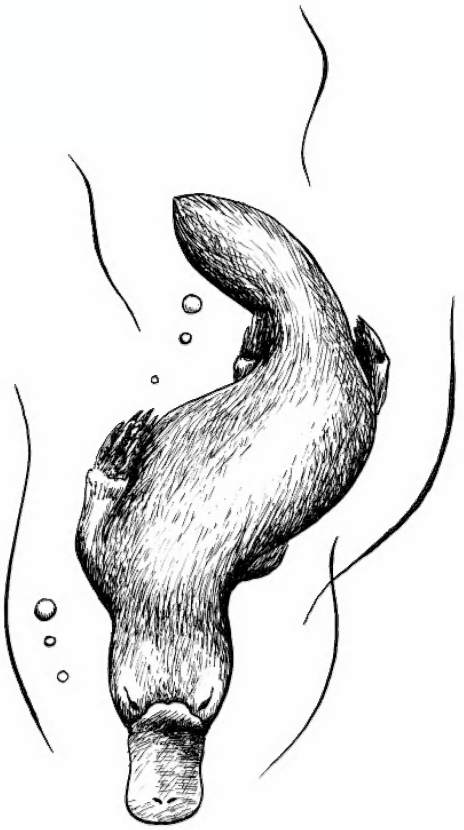

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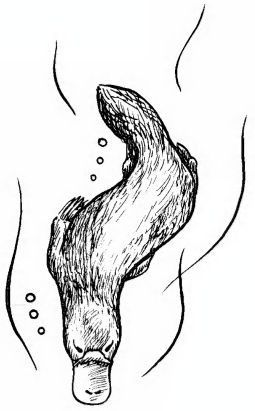

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Some observations on cushion plants on Mount Wellington 1982–2024

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Abstract

Changes in the diameter of the cushion plant *Abrotanella forsteroides* on Mount Wellington are profiled from 1982 to 2024. Estimates of cushion growth for the first four decades post-fire were consistent, with diameter increases of ca. 0.3 cm per year. Cushion area in three out of four 100 m^2 plots has been largely stable since 2014 with the remaining plot showing a gradual decline in total area since 2009. The recruitment pulse resulting from the 1962 and 1967 fires evident in 1982 has dissipated, especially recently, as a result of competition from non-cushion species and necrosis of some cushions.

Introduction

Martin (1940) wrote a seminal paper on the vegetation of Mount Wellington in which he described a succession involving the cushion plant *Abrotanella forsteroides* (Hook.f.) Benth. that colonises shallow flowing water which, over time, dammed the flow, facilitating further expansion of the cushions. When the cushions are about three feet in diameter they begin to die in the centre and form beds for invasion of other species, and if restricted drainage continues then swamps develop; if, however, they are breached, the succession tends toward grass and shrub vegetation (Martin 1940). This model was further developed by Jackson (1972) and Kirkpatrick and Gibson (1984) for the Central Plateau and Mount Field.

The main difficulty with testing successional models in alpine areas is the very slow growth rates seen in these environments that require studies over a very long term (Kirkpatrick et al. 2021) or, more commonly, substitution of

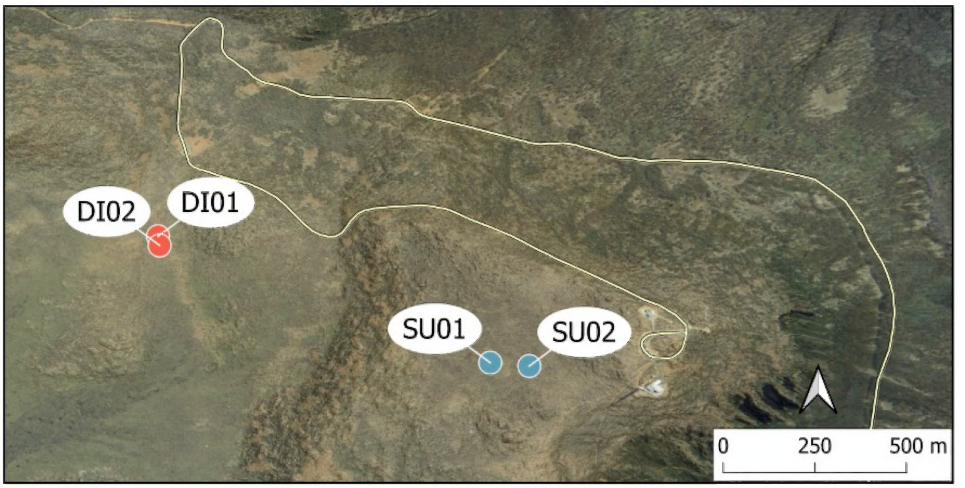

Figure 1. Location of plots established near summit of Mount Wellington in 2009. Pinnacle Road and carpark shown in yellow. (Aerial photo from theLIST © State of Tasmania, under Creative Commons CC BY Licence)

Plate 1. Recording cushion size classes at second summit plot in 2020 (58 years post-fire) looking NW over Thark Ridge toward Mount Field massif (left of centre). *Abrotanella forsteroides* cushion can be seen amongst dolerite boulders and encroaching shrubs. Photo: N. Gibson

time by space (Gibson & Kirkpatrick 1992; Kirkpatrick et al. 2002). Some 40 years ago I was interested in estimating the lateral growth rates in *A. forsteroides* on Mount Wellington and measured cushion diameters in four plots across two different fire ages, building on the earlier work of Turner (1981). The same general areas were revisited in 2009, and permanent plots were established and subsequently remeasured three times. The changes seen over the period 1982–2024 are described below.

Methods

In 1982 I measured size class distributions of *A. forsteroides* cushions in several 10 m × 10 m plots (A) in the summit area of Mount Wellington previously burnt in the small 1962 fire; and (B) near Dead Island in an area burnt in the much more extensive 1967 fire. These plots were not permanently marked (Gibson 1988). Some 27 years later, in 2009, four (10 m × 10 m) plots were set up, named SU01, SU02 for two near the summit of Mount Wellington, and DI01, DI02 for two near Dead Island (Figure 1, Plate 1). These were fixed with GPS waypoints and further located by taking a vertical photo of each corner and oblique photos across the plots. With these data it was possible to exactly relocate and remeasure the four plots in 2014, 2020 and 2024. Measurements were taken across the widest part of each cushion (to the nearest centimetre), with a second measurement at right angles to the first. These two measurements were averaged. The mean diameter was used to calculate area estimates assuming cushions to be circular; while this is a simplification, it should be adequate to examine decadal trends. Where cushions were significantly invaded by other species (and no longer continuous) or fragmenting due to cushion dieback, the smaller live continuous cushion surfaces were measured. All cushions that fell partly within quadrats were included.

Results

Size class

Original data from 1982 could not be relocated but histograms using 2 cm size classes are available, as are data on the number of cushions in each plot (Figure 2; data from Gibson 1988). As the

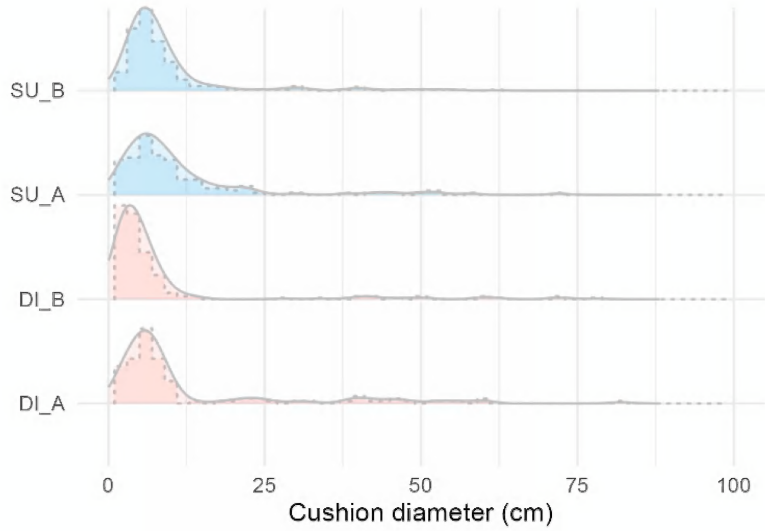

Figure 2. Density plots of *Abrotanella forsteroides* cushion diameters (solid line) and the original 2 cm size class histograms (dotted line) recorded on Mount Wellington in 10 m × 10 m plots in 1982. The plots in the summit area (blue) were located in an area burnt in 1962, while plots in the Dead Island area (red) were located in the 1967 burn (from Gibson 1988). Bin width in density plots set to 2 cm.

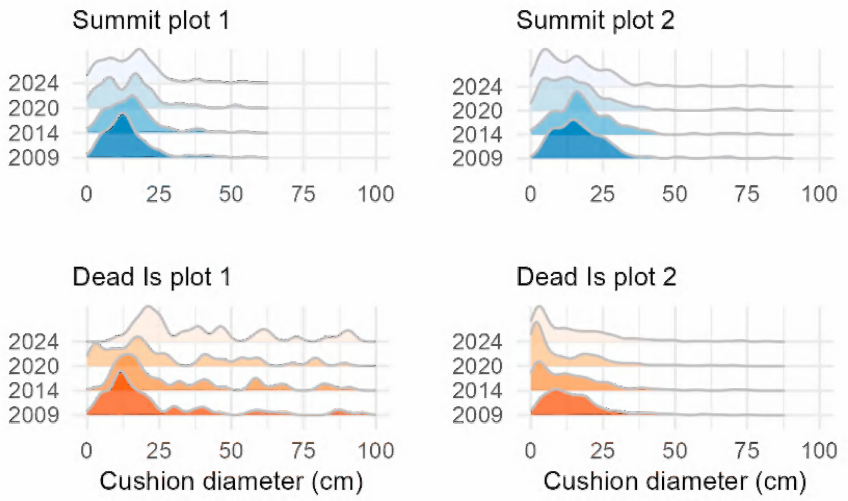

Figure 3. Density plots (smoothed histograms) of cushion size in permanently located plots for the four measurement periods. Plots in summit area were located in area burnt in 1962; plots in Dead Island area were located in the 1967 burn. Bin width in density plots set to 2 cm.

exact location of the 1982 plots is not known, care needs to be exercised in comparing the first measurement to the later data. In 1982 all four plots were dominated by a narrow distribution of small size classes, interpreted as a pulse of regeneration following the pre-ceding fires (Turner 1981; Gibson 1988). Using peak density as a measure of growth between 1982 and the preceding fire event, annual diameter increase ranged between 0.29 and 0.39 cm per year.

The original pulse of regeneration could still be seen in the two summit plots and one of the Dead Island plots (DI01) in 2009, although the peak in the size distribution was larger (as could be expected), with an absence of the smallest size classes (Figure 2). The same pattern can be seen in these plots in 2014; however, the distribution was now broader and the peak less defined. By 2020, an increase in numbers of the smaller size classes can be seen in all three plots. This increase in the smaller size classes is still apparent in the summit plots in 2024 but has disappeared in the Dead Island plot (Figure 3). Estimating annual growth for these three plots from the peak density values for 2009 and 2014 gives annual diameter increases of 0.26–0.31 cm per year. By 2020, cushion invasion and necrosis were evident in these plots and therefore further estimates of annual growth became increasingly problematic.

The second Dead Island plot (DI02), while showing a similar distribution to those in the other three plots in 2009, was dominated by small size classes at the later sampling times (Figure 3).

Cushion numbers

The number of cushions recorded in the plots in 1982 was highly variable and not directly comparable to data collected in 2009 and later years as the 1982 plots could not be precisely relocated. As a result, data for the 1982 measurements are given as a range rather than individual values (Figure 4). The two summit plots showed a decrease in the number of cushions recorded between 2009 and 2014, after which they remained fairly stable.

Dead Island plot 1 (DI01) showed a similar pattern between 2009 and 2020, followed by a further decrease in 2024 (Figure 4), which is consistent with the disap-

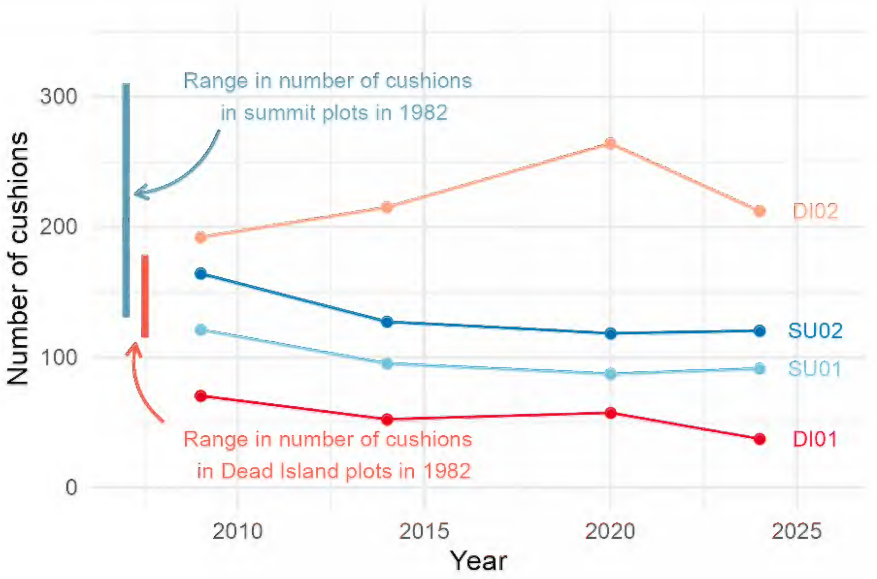

Figure 4. Bars on left show the range in number of cushions recorded in 1982 for the summit plots (blue) and Dead Island plots (red). Line plots show changes in the number of cushions recorded in permanent plots from 2009 to 2024; summit plots (blue shades) and Dead Island plots (red shades).

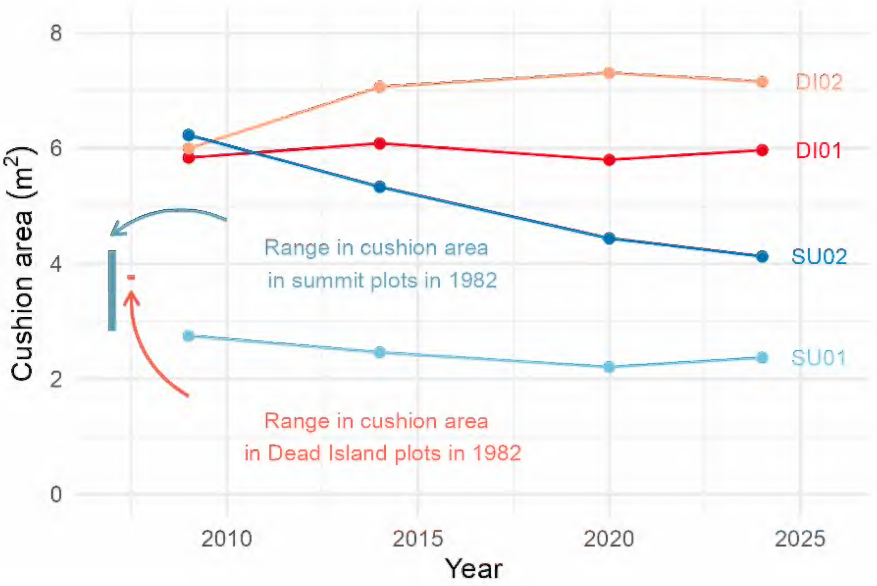

Figure 5. Bars on left show the range in total area of cushions (m^2) recorded in 1982 for the summit plots (blue) and Dead Island plots (red). Line plots show changes in total area of cushions (m^2) recorded in permanent plots from 2009 to 2024; summit plots (blue shades) and Dead Island plots (red shades).

pearance of the small size classes seen in the size class distributions (Figure 3). Dead Island plot 2 (DI02) showed an increase in cushion numbers from 2009 to 2020, followed by an almost 20% decrease between 2020 and 2024.

Cushion area

The total area of cushion in the 1982 plots ranged between ca. 3 and 4 m^2 (Figure 5). In 2009, total cushion area for three of the plots was ca. 6 m^2, with the remaining plot just under 3 m^2 (SU01). Three of the four plots showed little change in cushion area over the last 10 years, while the second summit plot showed a gradual decline of ca. 30% in area over the last 15 years (Figure 5).

Discussion

The dominant size class in the 1982 data was 4–6 cm in three plots (two summit plots and one Dead Island plot) and 0–2 cm in one plot near Dead Island. Most of the cushions in all plots were in small size classes, which is consistent with recruitment after the fires, but all four plots contained occasional larger cushions.

If the small cushions continued to grow without any competition or resource limitation, it could be expected that their size distribution would shift to the right (larger sizes) with time. Although the plots measured in 2009 were not in the same location as those measured in 1982, this pattern can clearly be seen and continued until 2014 in three of the four plots (excluding DI02). Calculating growth rates from changes in peak of the density distributions from 1982 to 2014 suggests a fairly consistent increase in diameter of ca. 0.3 cm per year for these plots.

By 2020, all plots were showing significant increases in numbers of smaller cushions. The shift to smaller size classes can be seen in one of the Dead Island plots (DI02) as early as 2014 (Figure 3). This increase in numbers of smaller cushions has resulted from the fragmentation of larger cushions both by invasion by other species (as predicted by Martin 1940) and by dieback of individual cushions (Plates 2 and 3), rather than from further recruitment. Not all larger size class cushions suffer invasion or necrosis, as evidenced by the long tails in the size class distributions at all sites across time (Figure 3), indicating long-term persistence

Plate 2. *Abrotanella forsteroides* cushion being invaded by *Oreobolus pumilio* R.Br., *Carpha alpina* R.Br. and the prostrate shrub *Epacris serpyllifolia* R.Br. leading to fragmentation. Dead Island plot 2 in 2020. Photo: N. Gibson

Plate 3. *Abrotanella* cushion fragmenting due to necrosis. Summit plot 2 in 2020, tape extended 28 cm. Photo: N. Gibson

in these communities. The large cushions probably represent fire escapes or resprouting individuals (Harding & Kirkpatrick 2018) but may also have arisen from cushion amalgamations. The largest cushion measured in this study had an estimated diameter of 95.5 cm, implying an age of over 300 years (assuming this is a single individual with a lateral spread of 0.3 cm per year). Martin (1940) reported cushion mounds up to nine feet in diameter on the mountain in the 1930s, three times the size of cushions encountered in this study; these mounds are likely to represent amalgamations of cushions rather than individuals.

The changes in total area of the cushions suggest that on Mount Wellington, maximal cushion development post-fire had occurred by 2009 (42–47 years post-fire) for three of the plots and by 2014 (47 years post-fire) for the remaining plot. In three of the plots, area growth and loss by necrosis or shrub invasion appear to be in balance with little change in total area over the last 10 years. The reason for the continued decline in cushion area at the second summit plot since 2009 is not clear but the shrub layer has become more continuous and there have been large shifts to

smaller size classes in both 2020 and 2024 (Plate 1, Figure 3). Although this site may not be conducive to cushion persistence in the longer term, on present trends the cushions are likely to persist for several more decades. No support was found for Martin's (1940) model of cushion expansion across drainage lines in any of the four plots; however, all were located relatively high in the catchment and these results may not be indicative of cushion dynamics across the whole of the plateau area.

Harding and Kirkpatrick (2018) considered that cushions could benefit from low-frequency and low-intensity fire through the opportunity to expand into areas previously occupied by shrubs. The observations reported here are consistent with that view, at least for the first 40–50 years post-fire.

The continued persistence of these alpine communities will depend on their ability to deal with our rapidly changing climate. While no clear signal of climate change is obvious in this observational study, earlier work showed *A. forsteroides* growth rates on Mount Wellington are only about half of those seen at Mount Field (Gibson 1988). Climate impacts on cushion dynamics may therefore become more evident on Mount Wellington earlier than on the mountains further west.

Acknowledgements

I am indebted to Alison Turner and the late Bill Jackson, who first got me fascinated by the flora of alpine Tasmania in general and cushion plants in particular. I also thank Kate Brown and Jamie Kirkpatrick, who assisted in field work, and my friends and colleagues who provided transport, accommodation, food and wine on my various return trips to the Island State.

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Larval gallery, pupation chamber, cocoon and two new larval food plant records for the wood moth *Endoxyla encalypti* Herrick-Schäffer, 1854 (Lepidoptera: Cossidae: Zeuzerinae)

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Introduction

Endoxyla encalypti Herrick-Schäffer, 1854 is a very large wood moth with females exceeding 180 mm in wingspan (Fearn & Maynard 2019) (Plate 1). It is widely distributed in coastal and near coastal habitats from south-east Queensland to southern Victoria and southern South Australia (Atlas of Living Australia 2024). This species has been reported in error from Tasmania for many years (Fearn & Maynard 2019). Since there is a remote chance that this species may occur on King or Flinders Island, this contribution may assist in distinguishing evidence of its occurrence from the closely related *E. lituratus* (Donovan, 1805), which is widespread in Tasmania.

Two phenotypic forms of *E. encalypti* are recognised. Specimens from central and southern NSW, Victoria and SA have a prominent white longitudinal streak on the forewing (Plate 2), whereas those from northern NSW and Queensland are without the white streak (Cocking et al. 2022) (Plate 1). Both forms are well documented in the taxon's images gallery on the Atlas of Living Australia (ALA) website.

The moth's larval hosts are trees and large shrubs in the genus *Acacia* Mill. (Fabaceae). Previously

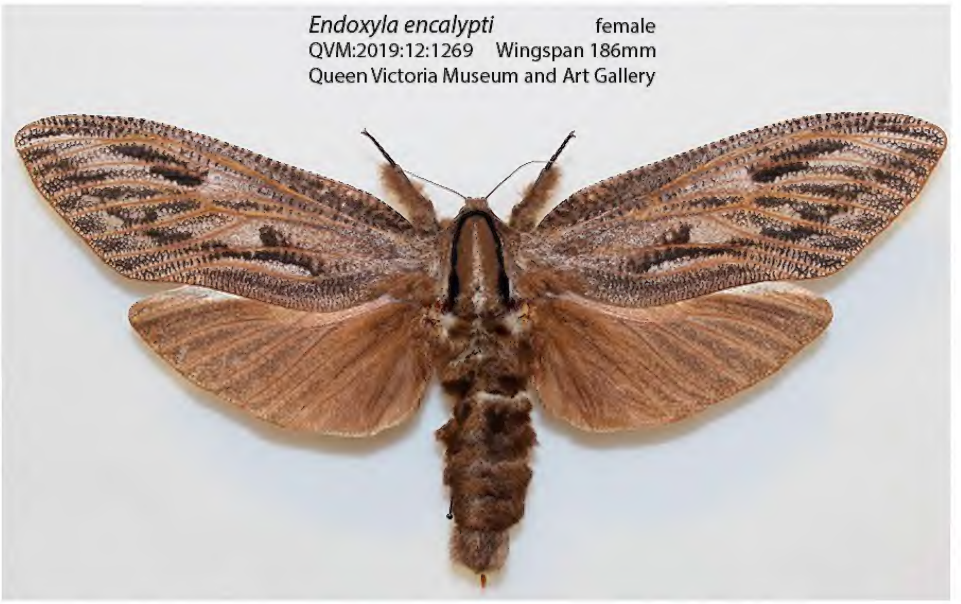

Plate 1. Female *Endoxyla encalypti* from south east Queensland. Photo: S. Fearn

recorded larval hosts are *A. dealbata* Link, *A. melanoxylon* R.Br. and *A. falciformis* D.C. (Simpson 1972). Larvae spend several years constructing a large gallery in the lower trunk and extending out into major lateral roots. Before pupation, the final-instar larva cuts a hole through the side of the root and forms a silk and wood fibre-lined passage upwards through the soil to just below the surface (Dodd

Plate 2. A recently eclosed male of the paler southern form (note white streak on forewing) of *Endoxyla encalypti* at You Yangs Regional Park, Victoria. Note pupal sheath protruding from emergence hole in ground at base of *Acacia implexa*. Photo: Echidna Walkabout Nature Tours

1916; Simpson 1972; Common 1990). Common (1990) suggested that a cocoon is formed within this tunnel through the soil with the pupa working its way to the surface and protruding from the ground at adult emergence (Plate 2). Less commonly, a gallery is constructed from the root into the base of the trunk just above soil level where a pupal emergence hole terminates just under the bark of the host tree (Zborowski & Edwards 2017) (Figure 1).

Endoxyla encalypti is sympatric throughout its range with the very similar looking *E. lituratus* (Fearn & Maynard 2019), which also utilises many species of *Acacia* as larval hosts (Fearn 1985, as *Xyleutes liturata*; Fearn & Maynard 2019). *Endoxyla lituratus* is typically smaller and lighter in colour than *E. encalypti* and displays different larval habits. Larvae bore singly in trunks, main stems and branches, and less commonly on large lateral

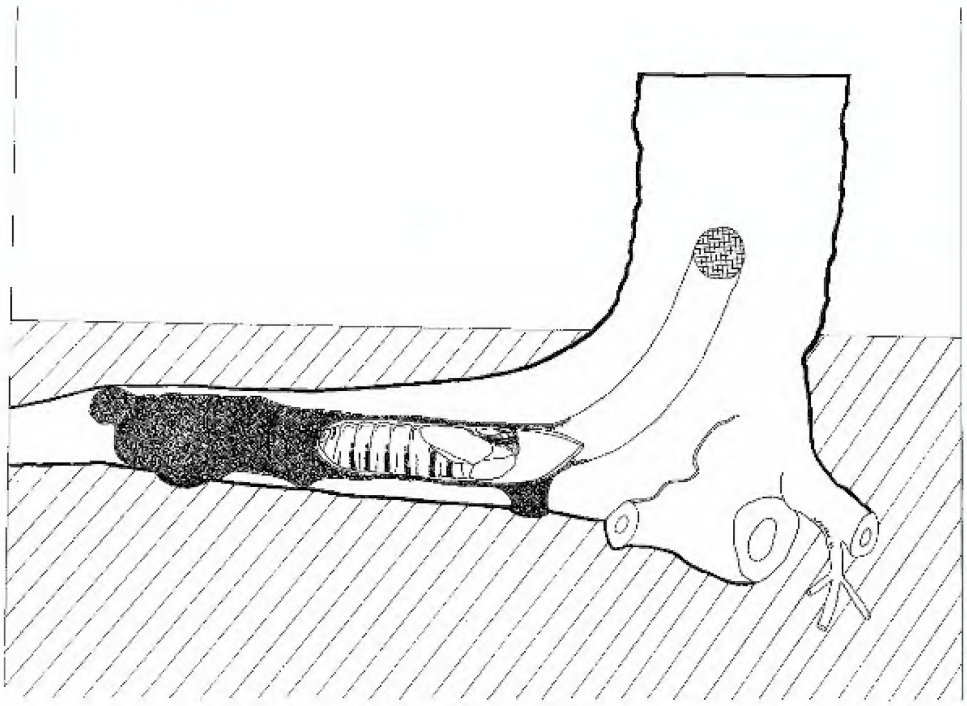

Figure 1. Lateral view of larval gallery, cocoon and pupa of female *Endoxyla encalypti* in the main lateral root of *Acacia fimbriata*. The emergence hole (hatched disc) was just above soil level in the trunk of the host tree. Illustration by S. Fearn, December 1993

Plate 3. Four recently prepared emergence holes of *Endoxyla lituratus* (yellow arrows) on the trunk and main stems of *Acacia melanoxylon* in Launceston, Tasmania. Note how the thin layer of bark left over the emergence hole is drying and beginning to fall away. Note old emergence holes (red arrows) beginning to heal. Photo: S. Fearn

roots that are *exposed above the ground surface*. A 200–300 mm long gallery is chewed out in the heartwood with a slightly wider diameter at its mid-point where the larva constructs a tough pupal cocoon of wood scrapings and silk. The larva feeds on regenerating cambium tissue at the bottom end of the bore, which has

Plate 4. Pupal sheath of *Endoxyla lituratus* protruding from emergence hole in main stem of *Acacia melanoxylon* after eclosion of the adult moth. Photo: S. Fearn

a small frass ejection hole opened up in the bark. Before pupation, the larva extends the top of the bore horizontally out to the bark. The bark is chewed away until a thin covering is left which often dries out and falls away during the pupal stage (Plate 3). At eclosion, the pupa wriggles out of the cocoon and up the bore using recurved spines on the abdominal segments before protruding from the emergence hole (Plate 4) (Fearn 1985; Fearn & Maynard 2019).

The two species, under a range of synonyms, were often confused in the early literature, particularly around the location of larval galleries in host trees. Froggatt

(1907, 1923) identified *E. encalypti* (as *Zeuzera eucalypti*) but the larval habits and gallery location he described are clearly those of *E. lituratus*. McKeown (1942, as *Xyleutes eucalypti*) and Simpson (1972, as *Xyleutes durvillei*) described larval habits that are clearly a composite of both *E. encalypti* and *E. lituratus*. Much of the earlier literature on *Endoxyla* in general includes observations that are now of little value because, due to name changes and misidentifications, it is not possible to determine which species were involved. A good example was outlined by Thurman (2022) regarding a fine illustration of various stages in the life history of '*Zeuzera macleayi*' by the natural history artist Harriet Scott in 1864. The adult female moth depicted in the plate as well as the larval and pupal galleries arising from the roots and terminating just under the bark on the trunk of an *Acacia floribunda* clearly refer to *E. encalypti*. The real *Endoxyla macleayi* Froggatt, 1894 is a giant cossid, the larvae of which develop in smooth-barked eucalypts (S. Fearn, unpublished data).

This paper describes and illustrates the larval gallery, pupation chamber and cocoon of a female *Endoxyla encalypti* for the first time, as well as documenting *Acacia fimbriata* A. Cunn. ex G. Don and *A. implexa* Benth. as larval host trees.

Field observations of larval gallery

In December 1993 the author discovered a recently eclosed female *E. encalypti* on the trunk of a Brisbane wattle (*Acacia fimbriata*) beside a footpath in The Gap, a western suburb of Brisbane. The empty pupal sheath was protruding from an emergence hole in the trunk of the tree just above soil level. The tree was relatively small with a stem diameter of 90 mm, so it was decided to cut the tree off just above the emergence hole and excavate the lower trunk and lateral roots from the ground. The tree only had one major lateral root which clearly contained the *E. encalypti* larval bore as in several places the larva had eaten all the way through the root with frass and wood scrapings being forced out into the surrounding soil. The pupal sheath, trunk and lateral root containing the larval gallery were removed and taken back to the author's residence for detailed examination. The trunk and lateral root were split in half and a

detailed, life-sized ink drawing (Figure 1) was made in the same way as the illustration of an *E. lituratus* larval gallery depicted in Fearn (1985, as *Xyleutes liturata*). The entire larval gallery was 244 mm long, the cocoon 100 mm long and the pupa 82 mm long.

An additional food plant record

During preparation of this paper, the author discovered a remarkable photo in the *E. encalypti* images gallery on the ALA website of a recently eclosed male taken in January 2014 at You Yangs Regional Park in Victoria (Plate 2). The original owner of the images was contacted and additional images taken at the same time were obtained, which allowed a botanist to identify the host tree as *Acacia implexa* from the details of fallen leaves on the ground at the base of the tree.

Discussion

The larval gallery, pupal chamber and cocoon were very similar to those of *E. lituratus* depicted in Fearn (1985). However, the cocoon constructed in the centre of the gallery was more crude and flimsy compared with that of *E. lituratus*. The inner wall of the cocoon was particularly poorly defined and was mostly just the wall of the gallery with a few silk strands attached. The outer cocoon wall was composed of a thin layer of coarse wood scrapings and silk. The opening end of the cocoon was nearly identical to that of *E. lituratus*, being loosely held together with silk but with a very resistant and tight opening.

The bottom end of the gallery was packed very tightly with wood scrapings and faecal material. No attempt had been made by the larva to eject this material from the gallery as is typical for large *Endoxyla* species that develop above ground in stems and branches. In those cases, distinctive piles of frass ejected from a small hole accumulate on the ground beneath host trees and are a good indicator of active larval bores. At several points along the portion of infested root, the larva had chewed right through into the surrounding soil enabling wood scrapings and faecal material to protrude. The larval gallery was so large that most of the structural integrity of the main lateral root was compromised. The larval

gallery may well have been longer if the thickness of the root had not tapered so abruptly.

The determining factor of whether the final instar larva constructs an emergence tube through the soil from the root or bores an emergence tunnel through the base of the host tree stump may relate to the length/diameter ratio of the lateral root and its depth below ground. Common (1990) states that *E. encalypti* larval galleries can extend up to a metre into lateral roots. The maximal sized female depicted in Figure 1 was possibly unable to construct such a large gallery because of the size of the host tree and the reduction in lateral root diameter over a relatively short distance.

One interesting departure from the *E. lituratus* galleries was the form of the emergence hole. *E. encalypti* leaves a relatively thick (2–3 mm) layer of bark over the emergence hole, which is also very firmly held in place with silk. Protruding pupal sheaths are therefore firmly gripped by the edges of the bark after they have pushed through the emergence hole. *E. lituratus* leaves a thinner layer of bark only lightly attached with silk which typically dries and splits in the sun and is often dislodged before the adult moth emerges (Plate 3).

The location of larval galleries in host trees will be an indicator of which large, *Acacia*-feeding species of *Endoxyla* is involved. Larval activity in subterranean lateral roots strongly indicates *E. encalypti*; however, *E. lituratus* will occasionally infest lateral roots, but only if they are well exposed *above* ground level. In such cases, the larval galleries are constructed exactly as they are in the normal situation of a vertical main stem, complete with frass ejected onto the ground surface as well as eclosion of the adult moth from an emergence hole on the top surface of the exposed root. *E. encalypti* is not known to expel frass above ground level.

Any larval galleries and emergence holes in main stems and branches above the ground will be *E. lituratus* (Plate 4). Because *E. lituratus* galleries are always initiated above ground and the bore can be up to 300 mm long, emergence holes will typically be further from the substrate than any *E. encalypti* emergence holes.

The author has examined hun-

dreds of *Endoxyla* larval galleries comprising five species. The galleries for each species are remarkably consistent in form and with experience the identity of the species involved can be reliably determined from larval gallery characteristics. The *E. encalypti* bore illustrated in this work is consistent with other examples examined by the author in the field.

Endoxyla encalypti appears to eclose during daylight hours on hot, clear days, which is a typical pattern for all large *Endoxyla* studied to date (Dodd 1916; Fearn 1985; Fearn & Leong 2022). The male moth in Plate 2 was discovered at 1426 h on a hot, sunny day with fully expanded and dry wings folded alongside the body in the normal way and so had clearly emerged some time before that. The reasons for diurnal emergence, when the greatest number of visual predators is active, are unclear, but Fearn and Leong (2022) speculated that the benefits of elevated temperatures and dry air that facilitate efficient drying and stiffening of the large wings of these giant moths outweigh the risks of predation.

Acknowledgements

Sincere thanks to Janine Duffy of Echidna Walkabout Nature Tours, Victoria, for supplying the author with her valuable Plate 2 image; Matthew Baker of the Tasmanian Herbarium for host tree identifications; and Peter McQuillan for reviewing the manuscript. Thanks also to an anonymous zoological reviewer at *The Tasmanian Naturalist* for helpful revisions, as well as Judy Rainbird, Kate Turner and Ross Smith (QVMAG) for their assistance with Plate preparations.

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Transects, paths, areas and WKTs

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Most natural history observations are based on points.

For example, imagine you see an orchid in flower near the Temma Road in the far Northwest. You take a photo of the orchid with your GPS-enabled smartphone and later upload the image to *iNaturalist*. Data embedded in the image tells *iNaturalist* that the orchid was at latitude −41.0603 longitude 144.6723, which is a single point in the landscape.

Or you pick up and identify a beetle near Pirates Road on the Tasman Peninsula. Your handheld GPS unit says the beetle is at the point −43.0358 147.8959, and you report the find and its point location to the *Tasmanian Natural Values Atlas* (TNVA).

Not all observations are based on points, however. Bird observers often record the species visible from a straight-line transect that might be more than a hundred metres long. Fungus enthusiasts might record the species they see along an old, meandering logging track, and a botanist might list all the tree species on a 50 × 50 m plot.

How should these non-point locations be recorded?

Generalising

A time-honoured approach is to generalise the non-point location as a point at the centre of a circle, where the circle includes the whole of the transect, path or area. You could say "these fungi were recorded along an old logging track at −41.8898 148.0365 plus or minus 500 m", where "500 m" is the radius of the circle around the point "−41.8898 148.0365".

The TNVA and many of the online platforms for biological records (like *eBird*) improve on this method by allowing you to manually draw a transect, path or area on a map or satellite image, although it's not always

possible to do this accurately, especially in dense bush! Furthermore, in the databases behind the platforms, the transect, path or area observations are usually generalised as a point and a radius. This allows for compatibility with point observations and for ease of sharing records between databases.

Not generalising

There is an alternative method for specifying non-point locations that is now widely used for biological records. It's called "Well Known Text", or "WKT" for short (https://en.wikipedia.org/wiki/Well-known_text_representation_of_geometry). It's a way of building lines and polygonal shapes from a set of points.

A 1650 m transect at the Cattle Hill Wind Farm, for example, might begin at the point −42.1332 146.7085 and finish at the point −42.1421 146.7248. The WKT representation is:

LINESTRING (146.7085 −42.1332,146.7248 −42.1421)

The "LINESTRING" part defines a line or set of lines. The points are listed in parentheses, longitude first, and separated with a comma.

A path is just a series of straight lines. Staying on Cattle Hill, I'll do another transect starting from the end of the first one:

LINESTRING (146.7085 −42.1332,146.7248 −42.1421,146.7023 −42.1355)

This very simple WKT format is accepted by most GIS and other spatial data programs. There are also free online WKT mappers, like https://wktmap.com/. Here's what my two-transect path looks like when mapped (Figure 1).

A sampling area can be represented as a regular or irregular polygon, and there is a WKT format for simple polygons. I'll add a third straight-line transect on Cattle Hill which finishes back at my first starting point, thus closing a triangle:

POLYGON ((146.7085 −42.1332,146.7248 −42.1421,146.7023 −42.1355,146.7085 −42.1332))

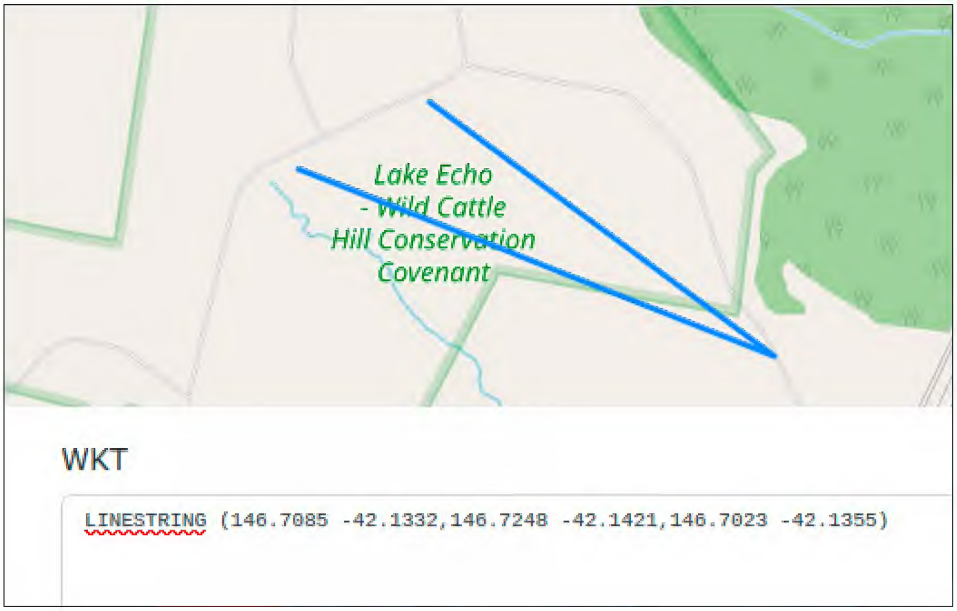

Figure 1. A WKT path (blue line) on Cattle Hill in an online WKT mapper.

For a polygon WKT, double parentheses are used to enclose the points, and the last point has to be the same as the first one. Here is my Cattle Hill polygon area when mapped (Figure 2):

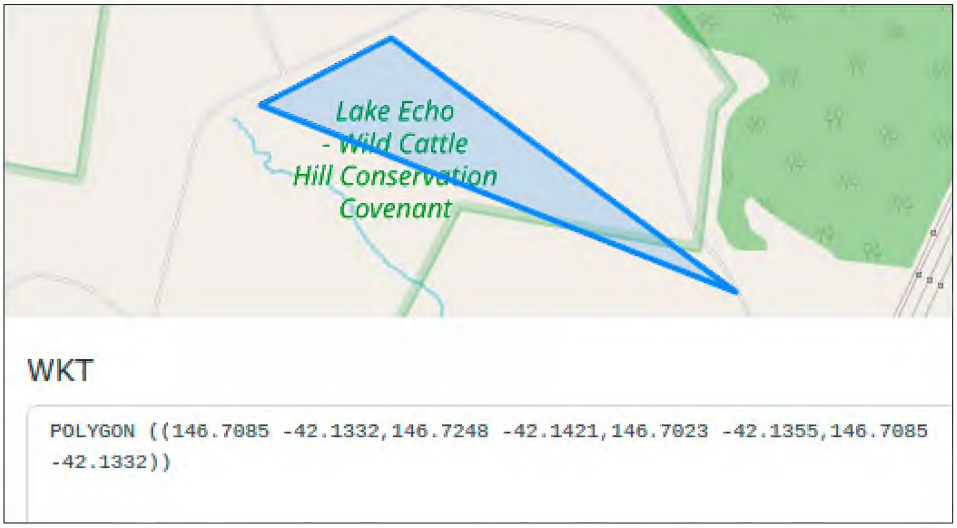

Figure 2. A WKT area (blue triangle) on Cattle Hill in an online WKT mapper.

Practical application

Despite the simplicity of WKT, most online platforms for recording natural history observations do not (yet) make it easy for users to enter a WKT as a location. However, WKT is an accepted feature of the Darwin Core standard (https://dwc.tdwg.org/terms/) used by the Global Biodiversity Information Facility (GBIF; the world's largest aggregator of biological records) and by the *Atlas of Living Australia*.

I keep my millipede records in Darwin Core. On the July 2024 outing of the Tasmanian Field Naturalists Club, several TFNC members and I collected millipedes along the track to and up Mt Ponsonby between Tunnack and Woodsdale. The total distance was about 1.2 km (Figure 3).

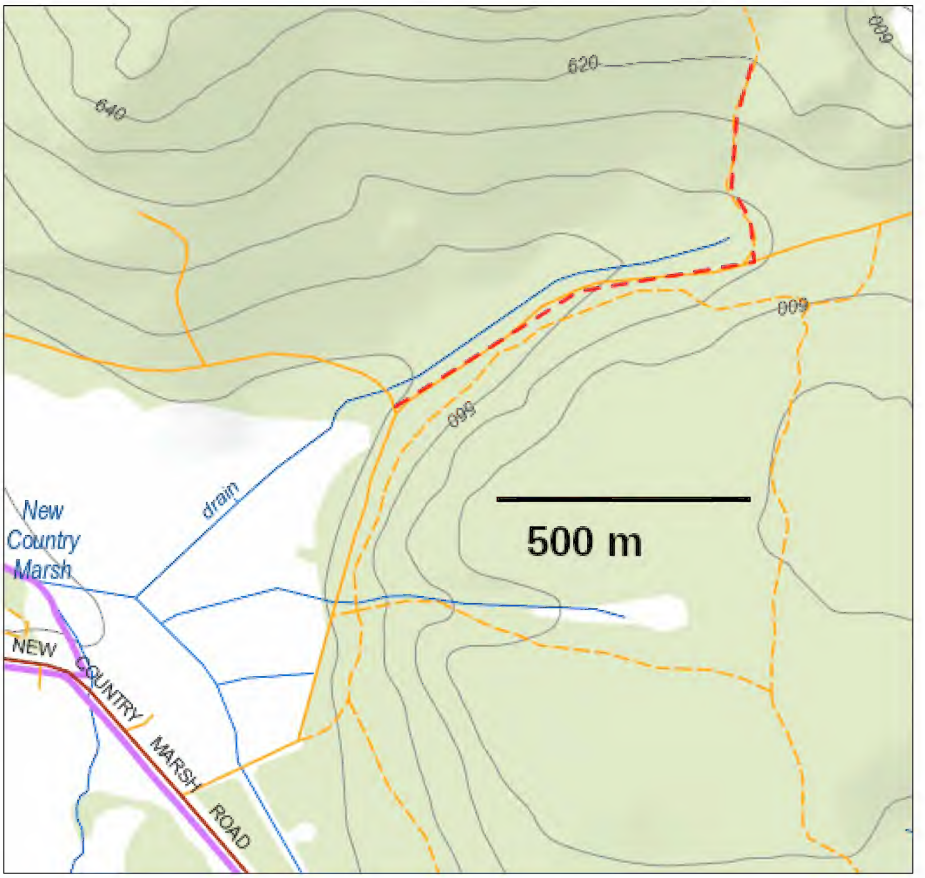

Figure 3. Sampling path (dashed red line) at Mt Ponsonby.

I located the millipede samples with a WKT based on four points I approximated with LISTmap, the Tasmanian Government's online spatial mapper (https://maps.thelist.tas.gov.au/listmap/app/list/map) (Figure 4):

LINESTRING (147.5303 −42.4855,147.5343 −42.4835,147.5387 −42.4829,147.5384 −42.4809)

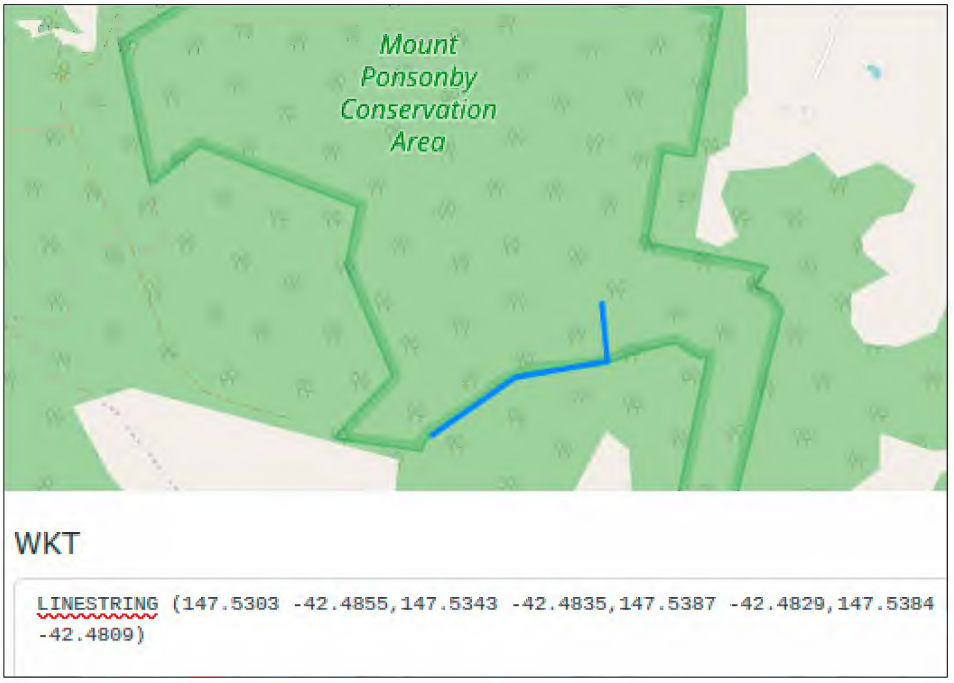

Figure 4. The Mt Ponsonby sampling path approximated as a three-line WKT, in an online WKT mapper.

Darwin Core also has categories for point locations, so I approximated a midpoint for the Mt Ponsonby path (−42.4834 147.5345) and estimated the radius of a circle that would enclose the whole of the sampling area (600 m). That gives me the old-fashioned "here plus/minus" version of the location. In Darwin Core the sampling location looks like this:

decimalLatitude = −42.4834

decimalLongitude = 147.5345

geodeticDatum = EPSG:4326 [same as "WGS84"]

coordinateUncertaintyInMeters = 600

footprintWKT = LINESTRING (147.5303 −42.4855,147.5343 −42.4835,147.5387 −42.4829,147.5384 −42.4809)

footprintSRS = EPSG:4326 [the datum for the WKT]

eventRemarks = sampling up to 15 m either side of the track

A WKT and any accompanying comments, like those in "eventRemarks" above, can also be entered in a TNVA record as extra information, and in the "Notes" field in some other online platforms.

If you are recording non-point natural history observations, consider using the WKT format to more accurately specify transects, paths and areas. The WKT format can also be used for points, multiple separate lines, multiple separate polygons and nested polygons. For technical details, a good source is the *Mapscaping* website, https://mapscaping.com/a-guide-to-wkt-in-gis/.

A frog arrives at Macquarie Island

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Plate 1. 'Gormay' the Macquarie Island frog. Photo by the author

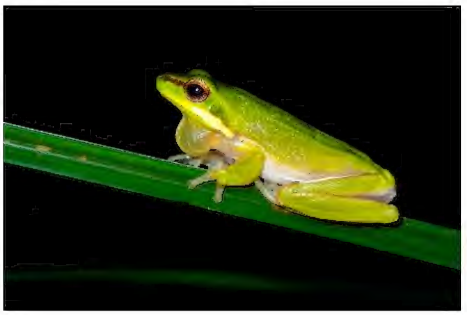

Plate 2. *Litoria fallax*, the eastern dwarf tree frog. Photo: Dr Jodi Rowley, Australian Museum.

Mentioning the arrival of a frog at Macquarie Island, especially following the island's recent and spectacular Pest Eradication Program (MIPEP), might just cause eyeballs to roll. However, 56 years previous, in 1967 to be precise, it was my primary responsibility with the Australian National Antarctic Research Expedition (ANARE) to continue Dr Robert Carrick's long-term life history research of the southern elephant seal, wandering albatross and royal penguin. Being more of a 'naturalist' than a research biologist, all sorts of other natural distractions were 'icing on my cake'. One of my more memorable was finding a small frog in our Mess Hall!

In early March, a few days after the repatriation of the 'summer party', I noticed the cook's cat playing with an object that appeared to jump. Closer inspection revealed this object to be a small frog about 3 cm in length (Plate 1). This I captured. A small aquarium, outfitted with moss and a screen lid, became our mascot's 'home'. Kelp flies, abundant along the high tide line, became the frog's tucker. Base members named 'him' 'Gormay' and got

considerable enjoyment watching him pursue 'kelpies', around the aquarium. I presumed this individual to be a male, due to the dark throat (vocal) sac.

One afternoon, someone inadvertently left the lid off the aquarium, allowing Gormay to make his escape. It was not until a week or two later that his dehydrated corpse was found behind a bookshelf.

A copy of my photo was sent to Dr Jane Melville, Curator of Amphibians at the Melbourne Museum, who suggests this frog is "most probably an eastern dwarf tree frog, *Litoria fallax*, sometimes called the 'banana box frog'" (Plate 2). The speculation is that Gormay arrived among the fresh vegetables or fruit brought south on the *Nella Dan*.

According to Dr Melville, this species has a propensity for turning up in strange places, "hidden inside fruit boxes", and "a number of invasive populations of this species have become established near large Australian cities".

Incidents such as this are lessons in just how easy it can be for alien animal and plant species to hitchhike to locations where they are '**NOT** wanted'! This is also a reminder (post-MIPEP) of the enormous effort and cost of eradication programs.

Acknowledgements

The author wishes to thank Dr Jane Melville, Curator at the Melbourne Museum, for her identification of this frog and information presented here.

Ongoing monitoring of Flame Robin (*Petroica phoenicea*) in June 2024 in south-east Tasmania

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Els Wakefield and Bill Wakefield surveyed six transects in south-east Tasmania in June from 2009 to 2014 to monitor Scarlet Robin (*Petroica boodang*) and Flame Robin (*Petroica phoenicea*) populations (Wakefield & Wakefield 2016). These surveys have been repeated from June 2020 to June 2023, as June is a month when robins have been present on all routes during the previous years of sampling while dispersing during the nonbreeding season (Wakefield & Vaughan 2022). There were substantial differences in Flame Robin numbers between the initial surveys and contemporary efforts. In 2024, Els Wakefield repeated these surveys.

Our primary focus was to enumerate Flame Robins, as flocks aggregating over winter reflect environmental conditions, mediated by altitudinal migration. This means that counting can provide an indication of trends in Flame Robin populations but also with time provide a species-specific insight into how environmental change may affect the spatial ecology of Tasmanian passerines.

Methods

Field methods

Six roads were driven around the vicinities of Blackbrush, Brown Mountain, Bruny Island, Runnymede, the Tasman Peninsula, and Tooms Lake. Each was surveyed on separate days, using the same

design as previously described in Wakefield and Vaughan (2020).

Analytical methods

All data visualisation was performed using R Studio (R Core Team 2024). Flame Robin numbers were calculated along all routes travelled in June 2024. The number of individuals observed was also counted for June data of all previous years sampled, to compare counts across years.

Results

Flame Robins were most numerous on the Bruny Island and Blackbrush routes (Figure 1). Bruny Island has featured consistently high abundance in recent years of surveying, but most sites have been characterised by some fluctuations between peak numbers and average numbers (Figure 2). The 2024 count was the lowest seen since 2014 (254 individuals recorded), though it remained higher than the median count for the 2009–14 survey block (230).

Discussion

There are several possible causes for different counts across years, including environmental change, overall population fluctuations, or site selection by individual birds over time. These interacting drivers warrant ongoing investigation, especially as anthropogenic change to native ecosystems accelerates. Australian bird species are declining in agricultural habitats (Bain et al. 2020), and these are the habitats favoured by nonbreeding Flame Robins during dispersal. This makes it especially important to understand how potential threats such as climate change may affect migratory dispersal behaviour in Tasmanian Flame Robins. Tasmania represents the southernmost limit of their range and is a likely climate change refugium (e.g. Amin et al. 2021), introducing the possibility that Tasmania may in future host a significant population of the species for biodiversity conservation.

Future surveys could be synchronised across routes, increasing confidence that population changes, rather than individual movements, are being detected in surveys. Equally, multiple surveys of each route in each season would allow for assessment of occupancy of each area over time. Expansion of the survey model to other parts of Tasmania would also provide a statewide perspec-

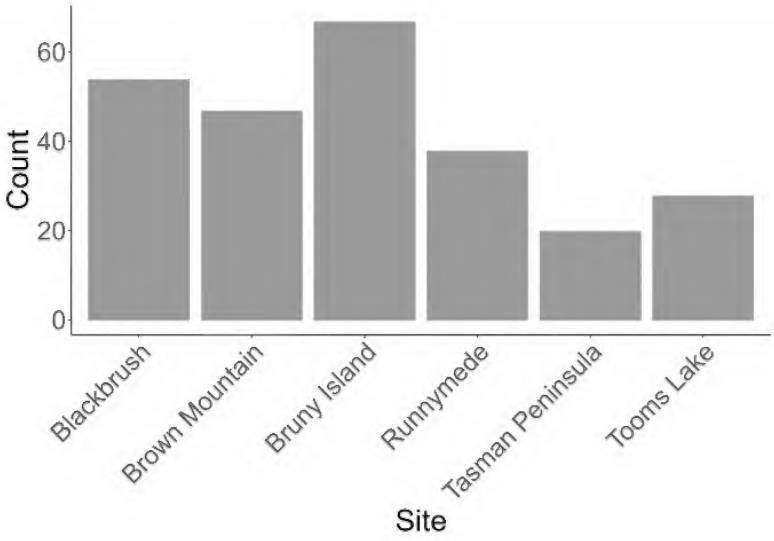

Figure 1. Count of Flame Robins (*Petroica phoenicea*) in June 2024 across six transects in south-east Tasmania, Australia.

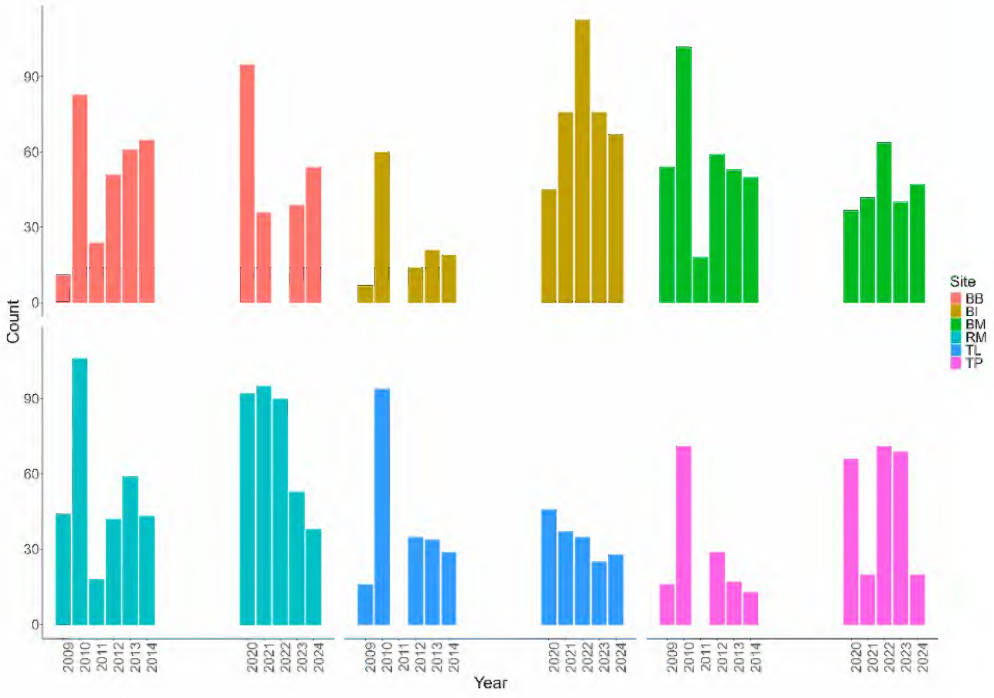

Figure 2. Counts of Flame Robins (*Petroica phoenicea*) in June (2009–24) along six transects in south-east Tasmania, Australia. The years 2015–19 were not sampled. Sites are Blackbrush (BB), Bruny Island (BI), Brown Mountain (BM), Runnymede (RM), Tooms Lake (TL), and Tasman Peninsula (TP).

tive on the winter dispersal of these highly mobile and iconic robins.

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Climbing Mount Tantalus, or, why a naturalist need never be bored

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Tasmania's famously rugged topography attracts bushwalkers and sightseers aplenty. For naturalists, it offers endless possibilities for encounters with nature, and with the diversity of species for which this island is home – sometimes the only home they have. You'll find species unique to mountain tops, and others only found in the valleys; and a warm, north-facing slope will host a different complement of species than will a cooler, south-facing slope. Geographical variations across the island in rainfall, cloud cover and propensity for fog, frost and snow add further to the diversity. The possibilities are endless.

Tasmania apparently has 2,906 named mountains, but Mount Tantalus isn't one of them. Nevertheless, I'd like you to come with me as we climb this mountain of my imagination. You'll need to be physically fit and of an optimistic disposition. As we set off, the mountain's lower slopes rise steeply at first, and we are forced to scramble, grabbing hold of branches with our hands and hauling ourselves up. Higher and higher we climb, and we're relieved to notice that the route is very gradually becoming less steep. In due course, it becomes more of a walk than a scramble. Our progress quickens, and before long we emerge onto a high plateau. From the point of inflection, where the steepness eases, we can't quite see the highest point so we stride across a seemingly endless expanse of moorland, the elevation now increasing almost imperceptibly. We should be able to see the summit cairn by now, we feel, but up here everything's shrouded in mist. We plod on through sodden, featureless moorland, where slow-flowing runnels drain from one peaty pool to the next. We must be there soon, surely? Onwards

we go. This is getting silly now. If we don't reach the top soon, we'll have to give up and turn around before we're benighted. We'll give ourselves another half an hour, navigating by compass. An hour later, exhausted, we admit defeat. We must have been tantalisingly close to the highest point, but it seems we're destined never to get there. We retrace our steps and eventually find ourselves back where we started, looking longingly back towards the plateau, which is still partially obscured by a veil of fog.

In ancient Greek mythology, the gods made the hapless Tantalus – a rather naughty demi-god – stand in a pool of water beneath a fruit tree with low branches. Tantalus grew hungry, yet the tree's fruits were always just out of reach; likewise, the water at his feet always receded whenever thirst drove him to bend down for a drink. My mountain is a bit like that: just when you think you must be getting close to the summit, sating your peak-bagging hunger, the ground stretches out ahead of you, continuing to rise ever so gently. Shrouded in fog, its summit remains forever out of reach. The profile of Mount Tantalus describes a line with a curvature that decreases continuously towards flatness, but never quite gets there: to use a mathematical term, it has no horizontal asymptote.

What has any of this got to do with Tasmanian nature? Well, in a sense, it *describes* nature, Tasmanian or otherwise. If you go out into nature, you'll see species after species after species, but you don't see *random* species. Let's say you're focusing solely on birds – maybe participating in a twitchathon, where the aim is to record as many species as possible in your allotted time-period (usually, a single day). The first birds you see will probably be common and widespread species: starling, blackbird, New Holland honeyeater, silvereye. You keep your eyes peeled and before long your list has swollen, with the addition of such moderately common species as brown thornbill, welcome swallow and silver gull, to name but a few. You listen out and add a couple of cuckoo species – rarely seen but with distinctive calls. But the more species you add to your list, the harder it becomes to add further species. You might have to make a special excursion to the rainforest to pick up scrubtit or

pink robin, but at least you are assured of doing so if you go to the right places. What about forty-spotted pardalote or shy albatross? They breed only in Tasmania, so they're on your wish list, but ticking them off involves a lot of travel to out-of-the-way places and a lot of luck. And then, how about magpie-lark, willie wagtail, white-necked heron or sacred kingfisher? These common birds of the Australian mainland aren't regularly sighted in Tasmania, but others have found them here on occasion so you're in with a chance at least. And if you're really, really lucky you might be the first person to observe some other vagrant bird species, new for the Tasmanian list. The prospect is *tantalising* and keeps you birding right up to the twitchathon deadline. Now, if you plot the accumulation of species (on a graph's vertical axis) against either the time or effort expended in seeing or hearing them (on the horizontal axis), then you will end up with a graph – a *species accumulation curve* – that looks rather like the profile of Mount Tantalus.

Birds are few in species, but even so, there is always the prospect of vagrants to prevent your species accumulation curve completely levelling off. Even my suburban garden bird list has eventually come to include such unlikely species as black swan, blue-winged parrot, native hen, white-throated needletail, masked owl, wedge-tailed eagle, short-tailed shearwater, gannet and little penguin – though I should point out that, to qualify, the bird has to have been either seen or heard in or *from* my garden. Now imagine you were on an insect twitchathon, where the species pool, even in Tasmania, comprises thousands upon thousands of species. You would still accumulate species rapidly at first (the rate moderated only by your ability to identify them all or to write all their names down), but eventually the rate would slow. You would never ever reach a plateau where you could truthfully declare that you had found every last species. If you were to find every *described* species, there would still be many *undescribed* ones. Even if you also found every undescribed species known from insect collections (the 'known unknowns'), there would still be many undescribed ones that hadn't yet been collected, or that lay unrecognised in a collection

because of similarity to other species (the 'unknown unknowns'). And Bass Strait isn't a complete barrier to insect travel either, with immigrants turning up all the time; but you never know which mainland species will do so next. That's why in the Mount Tantalus scenario we were never going to reach the highest point no matter how hard we tried, and why the path ahead lay obscured by a veil of fog that prevented us from predicting which species might appear next.

Now imagine that, instead of trying to find each insect through direct observation, you instead set up a dozen Malaise traps across your study area and leave them running for a month. These are tent-like structures that are a special form of flight intercept trap able to passively sample and accumulate trapped flying insects in a collecting head containing a pot of ethanol. You then work through the twelve samples sequentially, back in the lab. Everything that you identify from the first sample is a new record for your study. From the second sample, most of the insects belong to species that you had already recorded in the first sample, but there are also some further species that are new for your list (and, you note, some absences). The third sample contains rather fewer additions; the fourth fewer still, and so on. But even the final sample, number twelve, adds a handful of additional species. Now if you plot these out as a species accumulation curve, you will again end up with a profile like that of Mount Tantalus – although, with only twelve sample points, the curve would look rather staggered. If you had put out a few more traps, you would have ended up with a smoother curve and might have come closer to the highest point – but the chances are that your curve would still be heading gently but inexorably upwards. You could try changing the order of traps from which you built your curve. The precise shape would be slightly different, particularly if not all traps were sampling identical habitat; but the general trajectory would be the same. If you repeatedly changed the order and averaged the resultant numbers in a process called rarefaction, you would end up with a smoothed curve that was a fair model for the expected rate of species accumulation for your given trapping effort. You could then use

statistical techniques to predict how many species you might expect to find if you had put out even more traps, and how many traps you might need to completely sample the study area. There are lots of techniques for doing this, and they may give differing results. Some techniques struggle to cope with species absences (those rare species that were only found in one or two of the traps), and sometimes you have to mathematically transform your data so that it's not full of zeros (absences). But the key thing is that, once you see how wide the confidence intervals are (a statistical measure of uncertainty, plotted as vertical error bars above and below the line of your curve), it's hard not to conclude that we really have very little idea how many species we might have ended up with if we had continued sampling until we were adding no further species; in any case, the predicted additional sampling effort is usually so vast that we're unlikely to ever get there.

Bear with me now as I stretch these analogies a little further. Imagine another mountain in this landscape – let's call in Mount Abundance. This one has a *concave* profile rather than Tantalus's *convex* one: like a perfect ski slope, it gets steeper and steeper towards the pinnacle (or, starting from the pinnacle, gentler and gentler towards its base). Luckily, there's a helicopter to drop us off at the top – perhaps we're on a particularly well-funded Bush Blitz expedition – and all we need to do is get back down again in one piece, sampling along the way. Far below, we can see the vastness of the Singleton Plains stretching to the horizon. But between here and there is a precipitous drop that requires nerves of steel to scramble down safely. Eventually, the gradient lessens and we can walk without needing to grab hold of branches to steady our descent; a little while later, the gradient slackens further and our walk becomes a pleasant amble. But we still have a long way to go across the Singleton Plains to reach base camp and, in the end, it takes us longer to traverse the plains than it did to negotiate the steeper descent from the pinnacle.

The profile of Mount Abundance is similar to the curve arrived at if you plot the species that you observed or trapped in a particular study in decreasing order of abundance or incidence – it's called a *rank abundance* or *rank*

incidence curve. To continue with my twitchathon example, not only was the blackbird one of the first birds you spotted, but you went on to spot four-and-twenty blackbirds during your twitchathon (though you considered it unethical to follow the nursery rhyme's subsequent lines about baking them in a pie). Maybe starlings and New Holland honeyeaters were the next most frequently spotted, at fifteen and ten observations, respectively. Towards the other end of the frequency distribution, you only spotted scrubtits twice, while the shy albatross and forty-spotted pardalote were singletons, each appearing only on a single occasion. And you have this niggling feeling that if the twitchathon had gone on a bit longer, you might have spotted a tawny-crowned honeyeater, too, or maybe something really rare like a vagrant magpie-lark.

Rank abundance distributions that curve like the Mount Abundance–Singleton Plains profile are entirely typical in nature. The phenomenon is well characterised as the *commonness of rarity*, along with its corollary, the *rarity of commonness*. No matter what taxonomic group you choose to study, there tend to be a few abundant species, a smattering of uncommon ones and lots and lots of rarities that you only ever find once (singletons) or twice (doubletons) during your entire study. Some ecosystems are more uniform in their species composition than others, but there are always a few relatively common species and many uncommon ones. Even so, wherever you dive into nature, the long 'tail' of singletons leaves you wondering whether you have found all the rarities, or whether there are more out there that are even rarer – perhaps so rare, or just so hard to spot or trap, that you put your failure to record them down to your inadequate sampling effort.

Now you might be tempted to think that the solution to 'inadequate' sampling is to increase your effort: extend your study period, or increase the number of traps, or use a range of trapping techniques instead of just one. Surely, if you did that, then you would bump the numbers up and would be able to declare that you had sampled everything? Well, yes and no. Typically, the numbers are indeed bumped up: species recorded as singletons become doubletons, doubletons

now become tripletons or higher, and so on, right up to the most frequently recorded species now being recorded even more frequently. But the shape of the curve remains the same, because more and more *additional* singletons appear in the 'tail'. Mount Abundance gets higher and higher, but the Singleton Plains stretch out before you further than ever. And back on the plateau of Mount Tantalus, the highest point remains obstinately out of reach, still hidden in fog.

Theoretical ecologists have spent entire careers pondering the reasons for these species-abundance distributions, yet there is still no universally accepted single explanation. A longstanding school of thought focuses on how well a species is adapted to life at a particular place and time, relative to others present in its community – i.e., its 'realised niche'. By contrast, the 'unified neutral theory of biodiversity' instead 'explains' observed patterns mathematically without resort to ascribing different life-history attributes to component species. Essentially, it predicts that among trophically similar species, some will always be common and others rare, but whether a *particular* species is common or rare relative to others may vary in space and time, more or less by chance.

Notwithstanding this lack of agreement among the theoreticians, it's the sheer diversity of life described in these mountain analogies that I find so enthralling and that keeps me coming back for more. The analogies are scalable, too: they apply equally to individual days, expeditions or discrete research projects, right through to the entirety of one's lived experiences (my birding life-list is still growing, albeit very slowly these days). Though I am happy to lose myself in the company of everyday species in all their glorious abundance, there is always the tantalising prospect of encounters with rarities, too – whether by accident or by design. Those encounters may be fleeting and barely register; or they may be deeply meaningful, etched in the memory. I seek out the latter but accept all comers. In my chosen fields of study among the invertebrates, *perhaps* I'm now nearing a plateau and I'll start running out of species; but I doubt it. If that ever happens, there are plenty of other groups of animals, or plants, or fungi to explore – plenty more mountains to climb.

Immerse yourself in nature, in all its resplendent diversity, and there really is no room in life for boredom.

Further records of fungi, lichens and bryophytes from Tasman Island

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One of the recommendations in the flora survey of Tasman Island published in last year's *Tasmanian Naturalist* (Carle & McEldowney 2023) was to improve the list of Tasman Island's fungi, lichens and bryophytes. We note the 2005 Hamish Saunders Memorial Island Survey (HSMISP 2005), on which we had based the species list used in our 2023 paper had not included any fungi or bryophyte records.

We add here three lichens, nine bryophytes and one fungus to the list used in that paper.

One of the authors, Annabel Carle, returned to Tasman Island from 23 November to 2 December 2023 and collected three lichen species and three bryophyte species not previously recorded for the island, which she deposited into the Tasmanian Herbarium (HO). These were:

Lichens

Cladoniaceae:
Cladia aggregata (HO)

Lobariaceae:
Pseudocyphellaria neglecta (HO)

Teloschistaceae:
Teloschistes chrysophthalmus (HO)

Bryophytes

Leucobryaceae:
Campylopus introflexus (HO)

Lophocoleaceae:
Chiloscyphus sp. or *Heteroscyphus* sp. (HO)

Pottiaceae:
Triquetrella papillata (HO)

The authors were contacted in March 2024 by Dr Stephen Harris, who reported that in June 1982 he had collected the moss *Ischyrodon lepturus* (family: Fabroniaceae) from the shallow, well-drained dolerite soil on the steep eastern slope of the island in the vicinity of the old Tasman Island

haulageway. This was a new record for Tasmania (Harris & Ratkowsky 1982). The record has also been captured in the *Catalogue of Mosses of Australia and its External Territories* (Streimann & Curnow 1989).

This communication prompted us to contact staff at the Tasmanian Herbarium (HO), who confirmed we had also overlooked three other bryophyte species that Harris had collected on 17 June 1982 from Tasman Island. These were:

Polytrichaceae:
Polytrichum juniperinum

Pottiaceae: *Pseudocrossidium crinitum* (collected as *Barbula crinita*)

Racopilaceae:
Racopilum cuspidigerum
var. *convolutaceum*

During research for this note the authors also found a first record from Tasman Island for the moss *Chiloscyphus semiteres* (family Lophocoleaceae) recorded in the Atlas of Living Australia (ALA). This was collected during the lighthouse keepers' era, on 24 March 1959, by M.E. Gilham and the specimen is held by the National Herbarium of Victoria (MEL).

Plate 1. *Syntrichia papillosa* growing on the skull of 'Creamy' the Tasman Island cow. Photo: A. Thomson.

In July 2024, Amanda Thomson was processing photos of 3 April 2015 taken on Tasman Island of a moss growing on a cow's skull, which she posted on iNaturalist at https://inaturalist.ala.org.au/observations/226428973.

The skull belonged to 'Creamy' the cow, which had provided milk for the lighthouse keepers and their families (Plate 1). The skull had been sitting outside the back door of lighthouse keepers'

Plate 2. Close-up of the asexual gemmae of *Syntrichia papillosa.* Photo: A. Thomson.

Quarters 3 for some years. The moss growing on it has been identified as *Syntrichia papillosa* (family: Pottiaceae). Plate 2 clearly shows the asexual gemmae on its leaves. Although this is a new record for Tasman Island, this species is widely distributed in Australia, usually in dry sclerophyll habitats including coastal areas.

We also found that HO holds a fungal specimen we had previously omitted from our Tasman Island species list. This was collected by Penelope Tyson on 29 September 2007 and was recorded as Hysteriaceae: *Hysterium* sp. 'hyphae connecting a sprig of *Australina pusilla* to a *?Leptospermum* twig'.

The complete list of Tasman Island's plants, fungi, lichenised fungi and bryophytes with its explanatory appendix as at 6 August 2024 can be found online at:

https://tasmanisland.org.au/spreadsheet.htm

https://tasmanisland.org.au/appendix.htm

Acknowledgements

We sincerely thank Dr Stephen Harris for drawing our attention to his collection of Tasman Island bryophytes in 1982, and Amanda Thomson for her photographs and for information about 'Creamy' the Tasman Island cow and the moss growing on its skull.

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Table 1. List of Tasman Island Fungi/Lichenised fungi and Bryophytes at 6 August 2024

Notes:
(HO) = Specimen held by Tasmanian Herbarium
(iNat/NVA) = Research grade iNaturalist observation which will also be recorded on the Tasmanian Natural Values Atlas
(MEL) = Specimen held by the National Herbarium of Victoria
(ALA) = Observation recorded in the Atlas of Living Australia
AC & AMcE = authors Annabel Carle & Anna McEldowney
AC = Annabel Carle
PAT = Penelope A. Tyson
SH = Stephen Harris
MG = M.E. Gilham
SH and MG observations were recorded with a generic Tasman Island GPS location

Fungi/lichenised fungi						
Family	**Species name**	**Preferred common name**	**Longitude**	**Latitude**	**Observer**	**Observation date**
Agaricaceae	*Bovista brunnea*	true puffball	148.00596	−43.23378	AC & AMcE	26-Jan-23
Hysteriaceae	*Hysterium* sp. (HO) [hyphae connecting a sprig of *Australina pusilla* to a *Leptospermum* twig]	no common name	148.00103	−43.23195	PAT	29-Sep-07
Marasmiaceae	*Omphalotus nidiformis* (iNat/NVA)	ghost fungus	148.00664	−43.23868	AC & AMcE	31-Jan-23
Marasmiaceae	*Omphalotus nidiformis* (iNat/NVA)	ghost fungus	148.00336	−43.23323	AC	29-Nov-23
Cladoniaceae	*?Cladonia* sp.	fruticose lichen	148.00192	−43.2347	AC & AMcE	26-Jan-23
Cladoniaceae	*Cladia aggregata* (HO)	common coral-lichen	147.99990	−43.2402	AC	29-Nov-23
Lobariaceae	*Pseudocyphellaria neglecta* (HO)	specklebelly lichen	147.99969	−43.24014	AC	29-Nov-23

Parmeliaceae	*Usnea* sp.	beard lichen	148.00463	–43.23849	AC & AMcE	28-Jan-23
Parmeliaceae	*?Xanthoparmelia* sp.	rock-shield lichen	148.00518	-43.23940	AC & AMcE	30-Jan-23
Ramalinaceae	*Ramalina ?fastigiata*	dotted ribbon lichen	148.00167	–43.23926	AC & AMcE	28-Jan-23
Teloschistaceae	*Teloschistes chrysophthalmus*	golden-eye lichen	148.00583	–43.23361	AC & AMcE	27-Jan-23
Teloschistaceae	*Teloschistes chrysophthalmus* (HO)	golden-eye lichen	148.00240	–43.23309	AC	29-Nov-23
Bryophytes						
Fabroniaceae	*Ischyrodon lepturus* (HO)	no common name	148.00000	–43.23333	SH	17-Jun-82
Leucobryaceae	*Campylopus introflexus*	heath-star moss	148.00532	–43.23989	AC & AMcE	29-Jan-23
Leucobryaceae	*Campylopus introflexus* (HO)	heath–star moss	148.00215	–43.24059	AC	29-Dec-23
Lophocoleaceae	*Chiloscyphus semiteres* (MEL/ALA)	common crestwort	148.00000	–43.25000	MG	24-Mar-59
Lophocoleaceae	*Chiloscyphus* sp. or *Heteroscyphus* sp. (HO)	leafy liverwort	147.99972	–43.24028	AC	29-Nov-23
Polytrichaceae	*Polytrichum juniperinum* (HO)	juniper moss	148.00000	–43.23333	SH	17-Jun-82
Pottiaceae	*Pseudocrossidium crinitum* collected as *Barbula crinita* (HO)	beard moss	148.00000	–43.23333	SH	17-Jun-82
Pottiaceae	*Syntrichia papillosa* (iNat/NVA)	marbled screw-moss	148.00492	–43.23923	AT	03-Apr-15
Pottiaceae	*Triquetrella papillata* (HO)	no common name	148.00190	–43.23418	AC	28-Nov-23
Pottiaceae	*Weissia controversa* (HO)	green tufted stubble-moss	148.00518	–43.23943	AC & AMcE	30-Jan-23
Racopilaceae	*Racopilum cuspidigerum* var. *convolutaceum* (HO)	carpet moss	148.00000	–43.23333	SH	17-Jun-82

Highlights of pelagic birding from Eaglehawk Neck 2023–24

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This is the 13th in a continuing series of articles summarising the highlights of pelagic sea birding off Tasmania's coast. All species lists are available on eBird, where the data are available for analysis by anyone at this stage. For some pelagics, only a species list is given and others show a more comprehensive report including photos. Highlights are the best birds of the day as selected by experienced birders.

From July 23 to June 24 there were a record number of 52 trips departing from Pirates Bay on the Tasman Peninsula on the MV *Pauletta* skippered by John Males or his sons Michael and Brock.

Deckhands throughout the period included Mitchell Drysdale, Stacey Beswick, Simon Willey and Garry Woods.

Trip leaders and report writers were Paul Brooks, Ben Viola, Richy Everett, Richard Webber, Mona Loofs-Samorzewski, Rohan Clarke, Simon Gorta, Karen Dick, Rob Morris, Ramit Singal, Jens Sogaard Hansen, Daniel Terrington, Daniel Mantle, David Harper and Jeran Lin.

1 July 2023: The highlights were one Grey-headed Albatross (*Thalassarche chrysostoma*), 6 Grey Petrels (*Procellaria cinerea*), one Westland Petrel (*Procellaria aequinoctialis*) and a high count of 25 Cape Petrels (*Daption capense*).

2 July 2023:There was a rolling 5-metre swell. Bird highlights were one Salvin's Prion (*Pachyptila salvini*), one Southern Fulmar (*Fulmarus glacialoides*) and one Grey Petrel. Another highlight was a 6-metre Great White Shark (*Carcharodon carcharias*) that swam down the face of a wave and disappeared below the side of the boat.

15 July 2023:The highlight of this trip was a stunning white morph

Southern Giant Petrel (*Macronectes giganteus*) covered in widely spaced black markings.

16 July 2023: An Antarctic Tern (*Sterna vittata*) was the single highlight of the day.

29 July 2023: A Southern Fulmar and the high count of 26 Providence Petrels (*Pterodroma solandri*) were the two highlights.

4 August 2023: The three highlights were a single Blue Petrel (*Halobaena caerulea*), 8 Antarctic Prions (*Pachyptila desolata*) and 2 Slender-billed Prions (*Pachyptila belcheri*).

5 August 2023: This trip's highlights were another Blue Petrel and high counts of 60 Great-winged Petrels (*Pterodroma macroptera*) and 51 Grey-faced Petrels (*Pterodroma gouldi*).

6 August 2023: The highlight was an Antarctic Tern.

12 August 2023: Three Northern Royal Albatrosses (*Diomedea sanfordi*) and 50 Common Diving Petrels (*Pelecanoides urinatrix*) were the day's highlights.

13 August 2023: No less than 6 Blue Petrels, 3 Grey Petrels and one Brown Skua (*Stercorarius antarcticus*) were reported as highlights of this trip.

20 August 2023: Highlights were one Antarctic Tern, one Southern Fulmar and one Grey Petrel.

13 September 2023: A total of 250 Fairy Prions (*Pachyptila turtur*) and 7 White-headed Petrels (*Pterodroma lessonii*) were the highlights.

16 September 2023: An Antarctic Tern, 5 White-fronted Terns (*Sterna striata)*, a high count of 58 Sooty Shearwaters (*Ardenna griseus*) and 2 Juvenile White-capped Albatrosses (*Thalassarche steadi*) were highlights.

17 September 2023: A single Westland Petrel was the day's highlight.

24 September 2023: Two Broad-billed Prions (*Pachyptila vittata*), one Blue Petrel and one Flesh-footed Shearwater (*Ardenna carneipes*) were the highlights.

25 September 2023: Highlights were one Broad-billed Prion, 2 Westland Petrels and 20 Antarctic Prions (*Pachyptila desolata*).

26 September 2023: Highlights were one Arctic Tern (*Sterna paradisaea*), one Slender-billed Prion and one Salvin's Albatross (*Thalassarche salvini*).

29 October 2023: An old, very white Wandering Albatross (*Diomedea exulans*) was the day's highlight.

30 October 2023: This trip had an early record of a Buller's Shearwater (*Ardenna bulleri*) as the highlight.

4 November 2023: A Juan Fernandez Petrel (*Pterodroma externa*) was reported on this pelagic, only the second record for Tasmania.

5 November 2023: Highlights were 17 Mottled Petrels (*Pterodroma inexpectata*) and 2 Long-tailed Jaegers (*Stercorarius longicaudus*).

11 November 2023: A very rough trip was cut short by the weather but a single Buller's Shearwater was sighted on the return trip.

12 November 2023: Fortunately, conditions were better for the second trip of that weekend and a Salvin's Albatross was the highlight.

18 November 2023: There were 4 Gould's Petrels (*Pterodroma leucoptera*) and 14 Buller's Shearwaters at sea and on the Hippolytes there were 7 Great Egrets (*Ardea alba*) with one in full breeding flush. An enormous sunfish (*Mola* sp.) was observed as we headed back to port. It allowed close approach and flipped over on its side as we came abreast of it.

19 November 2023: Many highlights on this trip included one Arctic Tern, one Black-bellied Storm-Petrel (*Fregetta tropica*), 3 Cook's Petrels (*Pterodroma cookii*), 27 Gould's Petrels, 20 Mottled Petrels and 19 Buller's Shearwaters. A Humpback Whale (*Megaptera novaeangliae*) was seen blowing and a large Shortfin Mako Shark (*Isurus oxyrinchus*) was hanging around the boat in pelagic waters.

5 December 2023: Highlights were 2 Wedge-tailed Shearwaters (*Ardenna pacifica*), one Cook's Petrel, 2 Mottled Petrels and 3 Buller's Shearwaters.

7 December 2023: A Flesh-footed Shearwater and a Hutton's Shearwater (*Puffinus huttoni*) were the highlights, and the unusual behaviour of a Little Penguin (*Eudyptula minor*) feeding in the berley trail was observed.

10 December 2023: Highlights were one Cook's Petrel, one White-headed Petrel and one

sunfish.

16 December 2023: Eight Wedge-tailed Shearwaters, 7 Cook's Petrels and 16 Buller's Shearwaters were the highlights.

17 December 2023: Highlights included one Wedge-tailed Shearwater, one Black-bellied Storm-Petrel, 10 Cook's Petrels and 8 Buller's Shearwaters.

10 January 2024: Thirty White-faced Storm-Petrels were the highlight.

29 January 2024: Highlights were 30 White-chinned Petrels (*Pterodroma aequinoctialis*), 30 White-faced Storm Petrels (*Pterodroma marina*) and 10 Grey-backed Storm Petrels (*Garrodia nereis*).

3 February 2024: A single Grey Petrel was the only summer record of this species for a Tasmanian pelagic. There were also 6 Soft-plumaged Petrels and 17 White-headed Petrels as highlights.

4 February 2024: Eleven Gould's Petrels were the highlight.

10 February 2024: One Gould's Petrel was the highlight.

11 February 2024: An outstanding highlight was an adult Chatham Albatross (*Thalassarche eremita*); other highlights were 2 Cook's Petrels and 4 Buller's Shearwaters.

17 February 2024: A Kermadec Petrel (*Pterodroma neglecta*), a Cook's Petrel and 3 Buller's Shearwaters were the highlights.

25 February 2024: The highlights were a Pomarine Jaeger (*Stercorarius pomarinus*) and a Wandering Albatross with leg bands.

10 March 2024: One Soft-plumaged Petrel was sighted near the Hippolytes on return to port after the trip was shortened because of poor conditions.

31 March 2024: Highlights were one Gould's Petrel, one Soft-plumaged Petrel and 3 White-headed Petrels.

14 April 2024: A Sooty Albatross (*Phoebetria fusca*) was the first April record for an Eaglehawk Neck pelagic.

11 May 2024: The many highlights included one Kermadec Petrel, 5 Westland Petrels, one Sooty Albatross, 4 Light-mantled Albatrosses (*Phoebetria palpebrata*), one Black-bellied Storm Petrel, 60 White-headed Petrels and 2

Plate 1. The 44-year-old banded Wandering Albatross in flight. Photos: Jeran Lin

Buller's Shearwaters.

12 May 2024: Three Westland Petrels, 9 Light-mantled Albatrosses and 39 White-headed Petrels were the highlights.

26 May 2024: Two Southern Fulmars, 3 Blue Petrels, 88 White-headed Petrels and 5 Soft-plumaged Petrels were the highlights.

27 May 2024: Two Southern Fulmars and a very old, very white Wandering Albatross were the highlights. The albatross was photographed by Jeran Lin and Hsao Hsien Lail from Taiwan (Plate 1). It was sporting a white Darvic band number 426. The Australian Bird and Bat Banding Scheme (ABBBS) has identified this bird as one that was banded as a nestling at Bauer Bay on Macquarie Island in August 1980. At just shy of 44 years old, it is the second-oldest known Wanderer in the ABBBS database. The bird is a male and has been a successful breeder over the years, raising 12 chicks. The oldest recorded Wandering Albatross is a bird that was beach-cast in South Australia at 44.5 years.

On this trip, the Taiwanese also photographed a Southern Royal Albatross (*Diomedea epomorpha*) with a radio transmitter glued to its back. This bird is a breeder from Campbell Island and is part of research conducted by the New Zealand Department of Conservation.

2 June 2024: The highlights of this trip were one immature Salvin's Albatross, one large rorqual – probably a Fin Whale (*Balaenoptera physalus*) on blow shape and size, a mixed pod of

Long-finned Pilot Whales (*Globicephala melas*) and Oceanic Bottlenose Dolphins (*Tursiops truncatus*).

5 June 2024: An Arctic Tern, 3 Southern Fulmars and a Blue Petrel were the highlights.

6 June 2024: One Westland Petrel and 3 Southern Fulmars were the highlights.

7 June 2024: The highlights included 9 Southern Fulmars, 3 Light-mantled Albatrosses and 332 Buller's Albatrosses.

8 June 2024: Three Westland Petrels, 9 Southern Fulmars, 2 Grey Petrels and one Light-mantled Albatross were the highlights.

9 June 2024: This trip had 4 Westland Petrels, 18 Southern Fulmars, one Grey-headed Albatross, 4 Blue Petrels, one Grey Petrel and 2 Slender-billed Prions as highlights.

14 June 2024: The last trip for the financial year had one Sooty Albatross, one Light-mantled Albatross, 4 Southern Fulmars, 3 Blue Petrels and 2 Grey Petrels as the highlights.

Acknowledgements

I thank the skippers and the deckhands for looking after us, and the trip leaders and report writers for keeping the records.

Thanks also to Paul Brooks for his help with this article and to Jeran Lin for his photographs of the Wandering Albatross.

Bird and other species list: pelagic highlights 2023–2024 (IOC Taxonomy v.10)

Diomedeidae: albatrosses

Wandering Albatross (*Diomedea exulans*)

Southern Royal Albatross (*Diomedea epomorpha*)

Northern Royal Albatross (*Diomedea sanfordi*)

Sooty Albatross (*Phoebetria fusca*)

Light-mantled Albatross (*Phoebetria palpebrata*)

Grey-headed Albatross (*Thalassarche chrysostoma*)

White-capped Albatross (*Thalassarche steadi*)

Salvin's Albatross (*Thalassarche salvini*)

Chatham Albatross (*Thalassarche eremita*)

Procellariidae: petrels and shearwaters

Southern Giant Petrel (*Macronectes giganteus*)

Common Diving Petrels (*Pelecanoides urinatrix*)

White-headed Petrel (*Pterodroma lessonii*)

Providence Petrel (*Pterodroma solandri*)

Mottled Petrel (*Pterodroma inexpectata*)

Gould's Petrel (*Pterodroma leucoptera*)

Cook's Petrel (*Pterodroma cookii*)

Blue Petrel (*Halobaena caerulea*)

Broad-billed Prion (*Pachyptila vittata*)

Salvin's Prion (*Pachyptila salvini*)

Antarctic Prion (*Pachyptila desolata*)

Slender-billed Prion (*Pachyptila belcheri*)

Fairy Prion (*Pachyptila turtur*)

Great-winged Petrel (*Pterodroma macroptera*)

Grey-faced Petrel (*Pterodroma gouldi*)

Grey Petrel (*Procellaria cinerea*)

White-chinned Petrel (*Pterodroma aequinoctialis*)

Westland Petrel (*Procellaria westlandica*)

Wedge-tailed Shearwater (*Ardenna pacifica*)

Kermadec Petrel (*Pterodroma neglecta*)

Sooty Shearwater (*Ardenna griseus*)

Buller's Shearwater (*Ardenna bulleri*)

Flesh-footed Shearwater (*Ardenna carneipes*)

Hutton's Shearwater (*Puffinus huttoni*)

Westland Petrel (*Procellaria aequinoctialis*)

Juan Fernandez Petrel (*Pterodroma externa*)

Cape Petrel (*Daption capense*)

Hydrobatidae: storm petrels

White-faced Storm-Petrel (*Pterodroma marina*)

Grey-backed Storm-Petrel (*Garrodia nereis*)

Black-bellied Storm-Petrel (*Fregetta tropica*)

Southern Fulmar (*Fulmarus glacialoides*)

Laridae: gulls, terns and skimmers

White-fronted Tern (*Sterna striata*)

Antarctic Tern (*Sterna vittata*)

Arctic Tern (*Sterna paradisaea*)

Stercorariidae: skuas and jaegers

Brown Skua (*Stercorarius antarcticus*)

Long-tailed Jaeger (*Stercorarius longicaudus*)

Pomarine Jaeger (*Stercorarius pomarinus*)

Spheniscidae: penguins

Little Penguin (*Eudyptula minor*)

Ardeidae: herons and bitterns

Great Egret (*Ardea alba*)

Chondrichthyes: SHARKS, RAYS, SKATES AND CHIMAERAS

Great White Shark (*Carcharodon carcharias*)

Shortfin Mako Shark (*Isurus oxyrinchus*)

Molidae: ocean sunfishes

Sunfish (*Mola* sp.)

Cetacea: Delphinidae: DOLPHINS

Long-finned Pilot Whale (*Globicephala melas*)

Oceanic Bottlenose Dolphin (*Tursiops truncatus*)

Cetacea: Mysticeti: BALEEN WHALES

Fin Whale (*Balaenoptera physalus*)

Humpback Whale (*Megaptera novaeangliae*)

Reviews

Australian Jewel Beetles: An Introduction to the Buprestidae

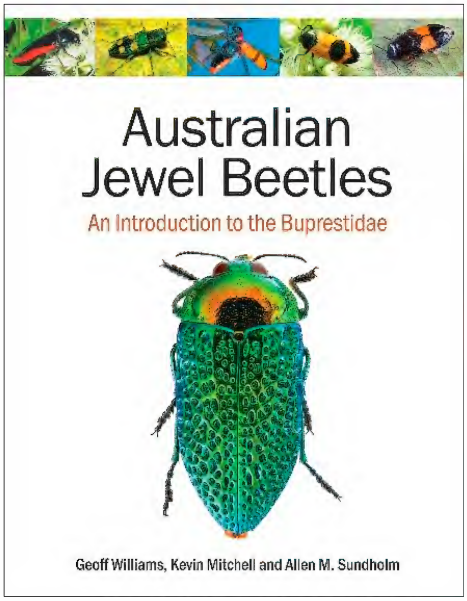
By Geoff Williams, Kevin Mitchell and Allen M. Sundholm

CSIRO Publishing, 2024

Hardcover, 224 pages (also available as epdf or epub)

$195.00

Reviewed by Keith Martin-Smith



Jewel beetles (family Buprestidae) are a diverse and conspicuous family of beetles with more than 15,000 described species, long prized by collectors for their metallic, iridescent colours. Beetlewing craft has been practised in Asia for hundreds of years and a dress featuring jewel beetle elytra was worn by Lady Curzon at the coronation of King Edward VII in 1903.

Australian jewel beetles are also diverse – more than 1,200 named species – and display high endemism at the generic and species level. Adults are exclusively active during the day, especially on warm, sunny days, which may also account for their popularity with collectors and photographers – no need to make expeditions in bad weather! Adults and larvae feed on plant material, either living or dead, and many have close associations with only a few related plant species.

This book is a comprehensive guide to all of Australia's known jewel beetles with 570 colour photographs of all genera and hundreds of different species (including some from Simon Grove at the Tasmanian Museum and Art Gallery). It is not a field guide – this would be a very difficult undertaking given the number of Australian species.

Regional field guides such as our own Tasmanian Field Naturalists Club publication (Cowie 2001) or Peter Lang's website for the Buprestidae of South Australia (http://syzygium.xyz/buprestidae/) can be used to identify jewel beetles from specific parts of Australia.

The book begins with a short introduction to the family, its fossil history, biogeography and ecology, particularly associations with plant species. The second and largest section is a systematic taxonomic treatment of all Australian genera organised alphabetically by genus within each subfamily. The description of each genus includes geographical distribution, comments and references. This section is preceded by colour photographs of preserved museum specimens and followed by colour photographs of live individuals. The third section describes the regional jewel beetle fauna with a comprehensive selection of colour photographs of different habitat types from all around Australia. Finally, there are a couple of pages on threats and conservation, and four Appendices including a checklist of all genera, and a summary of larval and adult plant relationships, as well as a glossary and a bibliography.

For a jewel beetle aficionado, it is a real treat to see the sumptuous photographs of many different species and to have a comprehensive summary of the current state of knowledge on distribution and ecology. The authors have brought their huge knowledge of jewel beetles together and produced an excellent, detailed treatment of this beguiling family. Of value is the discussion of the regional patterns of diversity and the host plant summaries – this gives the field naturalist lots of suggestions for places to search. However, at $195, this is not a casual purchase! I imagine that many people would probably borrow it from a library rather than owning it themselves, but it certainly deserves a place in the amateur entomologist's bookcase.

Reference

Cowie, D. (2001). *Jewel Beetles of Tasmania: A Field Naturalist's Guide*. Tasmanian Field Naturalists Club, Hobart.

Dragonflies and Damselflies of Tasmania

by Michael Driessen and Günther Theischinger

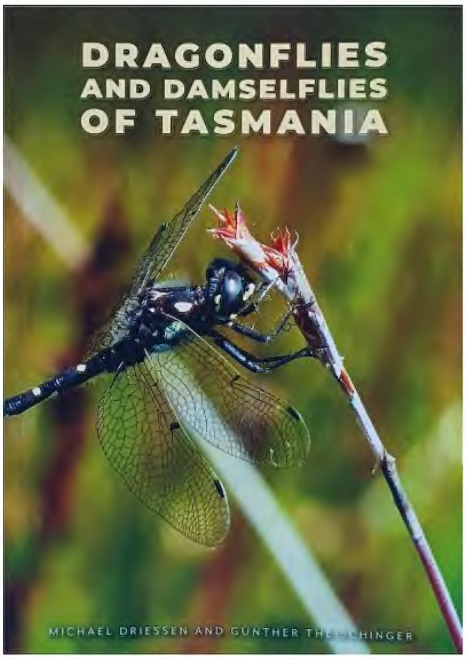
Tasmanian Field Naturalists Club, 2023

Softcover, 129 pages

$35

https://tasfieldnats.org.au/product/dragonflies-and-damselflies-of-tasmania/

Reviewed by Kristi Ellingsen



The odonatans are large and charismatic insects that have captured human imaginations and interest throughout history. *Dragonflies and Damselflies of Tasmania* is a meticulously crafted and comprehensive guide that will appeal to nature enthusiasts of all ages and expertise. The entertainment it provides can spread far beyond the insect aficionado. The reader need only browse to page 5 to discover that some lifeforms can have gills in their rectum and jet propel themselves via their anus. It would be interesting to find a person who doesn't raise an eyebrow to that and read on for more!

The authors combine their lifelong passions and extensive scientific careers to present a wealth of information in a compact volume. The initial chapters provide a brief yet engaging introduction covering the cultural significance, scientific history, biology, ecology, and conservation status of Odonata. The book then dedicates two pages to each of the 29 species found in Tasmania, many of which also occur on the Australian mainland. Clear and accessible descriptions of adult and larval stages are accompanied by diagrams that clarify key features. Additionally, each species entry includes a distribution map, a

habitat description and flight times, alongside high-quality photographs of both male and female adults. The layout ensures that the details for each species are presented in one convenient spread.

The second half of the book contains supplementary material that may be less essential in the field, but invaluable for formal identification. The glossary spans 12 pages and includes detailed diagrams of dragonfly and damselfly anatomy, both adult and larval. Full body diagrams are provided, and then a series of different body parts are specifically described. Unlike many similar guides, which often compress such information into hard-to-read compact boxes, this book's large, clear layout makes it easy to see exactly what the labels are indicating, which is fundamental to successful identification.

Following the glossary are two separate dichotomous keys – one for adults and one for larvae. It is common for field guides aimed at general readers to focus solely on adult insects, with only a cursory mention of their earlier life stages. However, Driessen and Theischinger break from this quite frustrating trend by providing full written descriptions of the larval stages for each species, complemented by specific keys and example diagrams of 11 families. Each step of the keys is given ample space and is supported by clear illustrations highlighting the critical features to observe.

The conclusion of the book also adds important and interesting snippets. For those who enjoy documenting their observations, the authors have included a handy table of flight times for each species, which can double as a checklist. A specific section also describes how to differentiate between males and females.

Whether you're an enthusiast of Australian wildlife or simply curious about these fascinating creatures, *Dragonflies and Damselflies of Tasmania* will be an informative and eventually dog-eared addition to your field guide collection.

Sponsorship

The Tasmanian Naturalist is published annually, with printing and distribution costs sourced directly from membership fees. With ever-increasing costs to production and the Club's recent shift to a higher quality presentation of the journal, which includes perfect binding, better quality paper and full colour, the Club now looks for support to offset the higher costs of production each year.

As well as the printed version of *The Tasmanian Naturalist*, electronic copies of every edition since inception are available on our website at:

https://tasfieldnats.org.au/naturalist/

Any individuals or organisations seeking to support the Tasmanian Field Naturalists Club Inc. through sponsorship of its annual scientific journal, should contact the Editor in the first instance. All sponsors are acknowledged in the Editorial Note at the beginning of the issue and in this sponsor statement (usually with a link to the sponsor's website), and receive hard copies of the journal for their own promotion.

Advice to contributors

The Tasmanian Naturalist publishes articles on all aspects of natural history and the conservation, management and sustainable use of natural resources, with a focus on Tasmania and Tasmanian naturalists. These can be either in a formal or informal style. Articles need not be written in a traditional scientific format unless appropriate for the content. A wide range of types of articles is accepted. For instance, the journal will publish articles that:

- summarise or review relevant scientific studies, in language that can be appreciated by field naturalists;
- stimulate interest in, or facilitate in identifying, studying or recording particular taxa or habitats;
- record interesting observations of behaviour, phenology, natural variation or biogeography;
- stimulate thinking and discussion on points of interest or contention to naturalists;
- put the study of natural history today into context through comparisons with past writings, archives, etc.; or
- review recent publications that are relevant to the study of Tasmanian natural history.

Book reviews, website reviews, poetry and prose, and other informal natural-history related content are also accepted. If you are thinking of submitting such material, please check with the Editor first, to avoid duplication of items such as book reviews and for appropriateness of content.

Submission of manuscripts

Manuscripts should be emailed to the editor at editor@tasfieldnats.org.au or to the Club's address. Contact the Editor prior to submission if you have any issues to discuss. Formal articles should follow the style of similar articles in recent issues and include an abstract. Informal articles need not fit any particular format and need not have an abstract. Unless otherwise stated, all images are by the author(s). All articles will be reviewed by the editors and/or external referees. Responsibility for accuracy and currency of taxonomic nomenclature rests with the author(s). It is important to refer to the Guidelines for Authors, available on the Club's website at www.tasfieldnats.org.au/naturalist/.

Submissions should be provided electronically in standard text files. Images, tables and diagrams should be submitted in separate files. They must be of high resolution and suitable to be published at A5 size.

Articles must be submitted by 31 August to meet publication schedules.

Tasmanian Field Naturalists Club

GPO Box 68, Hobart, Tasmania 7001
Founded 1904

Objectives

The Tasmanian Field Naturalists Club aims to encourage the study of all aspects of natural history and to advocate the conservation of our natural heritage. The club is comprised of both amateurs and professionals who share a common interest in the natural world.

Activities

Members meet on the first Thursday of each month; please check the website for details of the venue. These meetings include a guest speaker who provides an illustrated talk. An excursion is usually held on the following weekend to a suitable site to allow field observations of the subject of that week's talk. The Club's committee coordinates input from members of the Club into natural area management plans and other issues of interest to members.

The Tasmanian Naturalist

The Club publishes the journal *The Tasmanian Naturalist*. This annual journal provides a forum for the presentation of observations on natural history, and views on the management of natural values, in both formal and informal styles.

Membership

Membership of the Tasmanian Field Naturalists Club is open to any person interested in natural history. Members receive *The Tasmanian Naturalist* annually, plus a quarterly bulletin with information covering forthcoming activities.

Prospective members should either write to the Secretary at the above address, or visit our website at:

https://www.tasfieldnats.org.au

Membership rates

Adult	$30
Family	$35
Student/Concession/Pensioner	$25

Subscription rates for *The Tasmanian Naturalist*

Australia	$25
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